

A Knowledge-based Centric Approach to Local Area Network Learning System

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Abstract

This work is essentially a knowledge-based system for providing authentic knowledge about local area network (LAN) to its users, especially for those hardware engineers/computer scientists who just commenced their careers in the field of installation and maintenance of computer network. A knowledge-based system (KBS) is a computer program that reasons and uses a knowledge-base to solve complex problems. Previous studies have shown that motivating learners about local area network (LAN) design can be difficult when presented in the traditional lecture format. To overcome this problem, a knowledge-based tool (“KBLan-Designer”) that is web driven was developed as an aid in teaching and learning of LAN design at the introductory level. A KBLan-Designer provides a set of learning resources (tutorials, quizzes, network modeling, network design scenarios, key terms and definitions, and review exercises) that assists in learning the basics of both wired and wireless LAN design. The system is designed using php, javaScript for the front-end and MySQL for the back-end languages. These programming tools are best for an effective online system and its convenience of use. This flexible learning approach contributes positively to distance education and e-learning.

Keywords: Knowledge-based, Network, Virtual Learning, Information Technology IT.

1.0 Introduction

In today’s world information has become a major source of knowledge and in its paradigm, knowledge is power. Computer networking has become a major way of communicating information. According to Osuagwu, (2005) stated that networks necessarily mean that information is dispersed with valuable files on many occasions, with data being transmitted over different kinds of communication lines and with many people having access to the information. Networks is about interconnection of independent nodes to exchange or share information (Osuagwu, 2005). The learning of the localized area networks LAN design has been conventional; the problem statement therefore is that motivating learners about LAN design fundamentals can be difficult not only because of the abstract nature of the subject matter but delivery using traditional lecture method. To overcome this problem, there is need to develop a knowledge-based teaching suite that gives learner an interactive and flexible learning experience in

both wired and wireless local area network LAN design.

The objective of this work is to design an online knowledge-based system that provides and support learning in the practice and theory of networks with a scope that focus on local area network.

Significance: The significance of this study is to design a system which shall render assistance to the computer scientist to know about Local Area Network in an interactive and simplify way to avoid errors during the installation and maintenance of a computer network. Also, to enhance knowledge of proper installation of various components of the networks and achieve the prevention and corrective maintenance of system networks. It is pertinent to note that one area that Information Technology (IT) managers are looking for guidance is the complete integration of new technologies into existing LANs. Creating a voice over internet protocol IP network without consideration for the resources that already function in the LAN would be detrimental to an IT organization. Therefore, a developed knowledge-

based solution that gives an interactive and flexible learning experience in both wired and wireless LAN design is desirable.

1.1 Background

The elements of a network can be divided into two categories, one is the physical network; the wires, hubs, PCs, and other physical bits the network uses to transfer data. The other is the logical arrangement of these physical bits that is rules that enable the bits to work together. These facts of knowledge on the concept of computer networking is collection of facts, and to manipulate these facts by a program, a suitable representation is required to facilitates problem solving (Okumbor, 2014).

Knowledge and representation are two distinct entities, they play a central but distinguishable role in intelligent system. Knowledge is a description of the world, it determines a system competence by what it knows while representation is the way knowledge is encoded. It defines a system performance in doing something. Different types of knowledge require different kinds of representation because the knowledge representation models are often based on logic, rules, frames or semantic nets.

According to Poople et.al (1998), computer requires a well-defined problem description to process and provide acceptable solution. To collect fragment of knowledge we need first to formulate and then represent it in formal language that computer can understand, and use an algorithm to compute an answer.

2.0 Related Literature

An interconnected set of two or more computers may be called a 'Computer Network'. There are many possible advantages in using networks and the basic ones are: the sharing of resources and information; the provision of local facilities without the loss of central control; the even distribution of work; and improved communication facilities. Networks can be categorized but primarily be grouped into three: Local Area Network, Metropolitan Area Network and Wide Area Network.

A local area network (LAN) is a computer network that interconnects computers within a limited area such as a residence, school, laboratory, university campus or office building distance

(Gary, 2017). Metropolitan Area Network (MAN) are networks that cover a city. It can be seen as various LAN connected within a city to share information. While the Wide Area Network (WAN) are networks that cover nation and international. By contrast, a wide area network (WAN) not only covers a larger geographic distance, but also generally involves leased telecommunication circuits. Ethernet and Wi-Fi are the two most common technologies in use for local area networks.

Networks can be connected to one another through machines called gateways, which translates information in terms of hardware and software, thus creating the internet. The internet essentially connects different networks to one another, creating a global connected environment (Scott, 2016). However, in a wireless LAN, users have unrestricted movement within the coverage area. According to Lamont, (2018), wireless networks have become popular in residences and small businesses, because of their ease of installation. Most wireless LANs use Wi-Fi as it is built into smartphones, tablet computers and laptops and guests are often offered internet access via a hotspot service. The setup, installation and configuration of the networks are diverse; through the use of conventional methods, information technologies tools and knowledge-based system.

- a) Perspective of Knowledge-Based System: According to Sowa (2010), a knowledge-based system (KBS) is a computer program that reasons and uses a stored repository of database to solve complex problems. The term is broad and refers to many different kinds of systems, hence one common theme that unites all knowledge-based systems is an attempt to represent knowledge explicitly and a reasoning system that allows it to derive new knowledge. Thus, a knowledge-based system has two distinguishing features: a knowledge base and an inference engine. The first part, the knowledge base, represents facts about the world, often in some form of sub Sumption ontology (rather than implicitly embedded in procedural code, in the way a conventional computer program does). Other common approaches in addition to a sub Sumption ontology include frames,

conceptual graphs, and logical assertions. The second part, the inference engine, allows new knowledge to be inferred. Most commonly, it can take the form of IF-THEN rules coupled with forward or backward chaining approaches. Other approaches include the use of automated theorem provers, logic programming, blackboard systems, and term rewriting systems such as Constraint Handling Rules CHR (Smith, 2011).

- b) Building Blocks of Knowledge Based System: Knowledge-based system consists of two principal parts: the knowledge base; and the reasoning, or inference, engine. The knowledge base systems contain both factual and heuristic knowledge. Factual knowledge is that knowledge of the task domain that is widely shared, typically found in textbooks or journals, and commonly agreed upon by those knowledgeable in the particular field. While Heuristic knowledge is the less rigorous, more experiential, more judgmental knowledge of performance. In contrast to factual knowledge, heuristic knowledge is rarely discussed, and is largely individualistic. It is the knowledge of good practice, good judgment, and plausible reasoning in the field.

Knowledge representation formalizes and organizes the knowledge into encoded form. One widely used representation is the production rule which has a condition and an action. A rule consists of an IF part and a THEN part. The IF part lists a set of conditions in some logical combination. The piece of knowledge represented by the production rule is relevant to the line of reasoning being developed if the IF part of the rule is satisfied; consequently, the THEN part can be concluded, or its problem-solving action taken (Wayne, 2010). The problem-solving paradigm, organizes and controls the steps taken to solve the problem. One common but powerful paradigm involves chaining of IF-THEN rules to form a line of reasoning. If the chaining starts from a set of conditions and moves toward some conclusion, the method is called forward chaining. If the conclusion is known, for example, a goal to be achieved but the path to that conclusion is not known, then reasoning backwards is called for, and the method is backward chaining. These problem-solving methods are built into program modules called inference engines or inference procedures that manipulate and use knowledge in the knowledge base to form a line of reasoning.

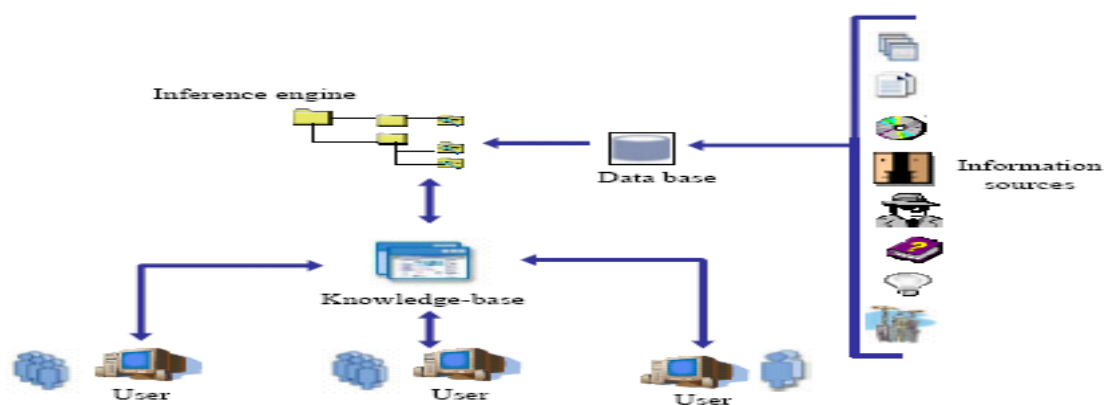


Fig. 1: Components of Knowledge-Based System

The knowledge-based as a repository of database that contain larger store of knowledge which allows the interpretation of the information in its database to the advantage in the diagnosis, design and

analysis of local area networks. The knowledge base is core of the system, consists primarily of a knowledge base and an inference engine, a couple of other features of reasoning with certainty and

uncertainty. Knowledge is almost always incomplete and uncertain. To deal with uncertain knowledge, a rule may have associated with it a confidence factor or a weight. The set of methods for using certainty features in combination with uncertain data in the reasoning process is called reasoning with uncertainty. Artificial Intelligence researchers will continue to explore and add to the current range of knowledge representation and reasoning methods (Dan, 2014). The representation of knowledge in the learning of local area network system could be virtual. The electronic learning is an aspect of virtual classroom that is concerned with sharing of knowledge electronically by use of text, video, web or any other information technology tools.

- c) The Local Area Network: LAN consist of many devices connected in a single system that is integrated by a continuous structural medium and is supportive of both low-speed and high-speed data communication (Osuagwu, 2005). It has characteristics such as: it is localized; has peer traffic patterns; covers a given geographical area and distance; possess bandwidth and transmission media; and usually has gateways, bridge and routines.

3.0 Study Methodology

The method adopted in this study considers the obvious and peculiar problems associated with the existing system and embark on pronounced review of the system. During the course of this study, data were collected from relevant authorities as to learning system of computer networks specifically on local area networks and personal experience on the teaching and design of local area networks. In the course of this research, the method adopted in data collected from relevant authorities through: Interview: This is a face-to-face discussion between the researcher and the respondent. It is indeed a direct communication involving the relation of facts and figures. Observation: This is the use of visual and visual aids like the eyes to study, compare, and analyze situations. Internet: In

this era of information and communication convergence, the internet was also a useful resource utilized in this research work.

3.1 Analysis of the Existing System: During the investigation, it was discovered that learning is only done on face to face on conventional basis. The existing system of this study has been the manual method of teaching Local Area Network (LAN) in the traditional way of face to face contact. A situation whereby the course is included in the learner's curriculum, and they will have to be present in class to receive the lecture. The problem with the existing system is that the learner must be on ground to receive the course ware, and this is common in higher institutions. The solution to the existing system is the proposed model of instruction that follows the learner centered principles of the knowledge based centric approach to online LAN learning system.

3.2 The Proposed System: The proposed system is a web-based LAN knowledge-based system designed with PHP and MySQL, on Apache server. Online lecture system is education that takes place over the internet; it is often referred to as e-learning among other terms. However, online lecture is just one type of distance learning, the umbrella term for any learning that takes place across distance and not in a traditional classroom. The advantages of the proposed system are: it is time saving as access to the e-learning platform with ease and at the comfort of one's home; it is stress free as with the knowledge of computing can be enhance; is cost effective as prospective learners do not need to travel far distance before accessing their learning materials; and it enhance the use of computer technology. The only disadvantage is that: the learner must have a good knowledge of computing before he/she will be able to use the system and the system cannot be run without the necessary hardware and software specifications.

4.0 System Design

The objective of this system design is to develop non-expensive interactive tools like message board tool, discussion group tool and chat tool to provide interaction between the learner and the instructor. The additional objective of this study is to design a system with reusable components, feasibility and

provision for system expansion without compromising system performance. The proposed system control center consists of the navigational paths in the system which flows from the login form to the main dash board where one can access the main software platform. This include: registration, login, exercises, and lesson.

4.1 Input/Output Database Specification: A database is a collection of data, which includes data in all forms such as texts, manuscripts, documents,

books, and video clips in addition to data stored on computer. Database model is the concept used to describe the structure or arrangement of data in a database. It could be relational, hierarchical, object-oriented and network database model.

The input design entails the various data supplied to the system which are processed to give out an output. The input is supplied to the system using computer keyboard mainly as an input device. For instance, the login specification is as shown in Table 1.

Table 1: Input Design for Login

Field	Type	Size	Default
Username	varchar (20)	7	0
Password	varchar (20)	8	0

The output of the design is a comprehensive report of the program. It is the result of processed input. The output for login is shown in Figure 2.

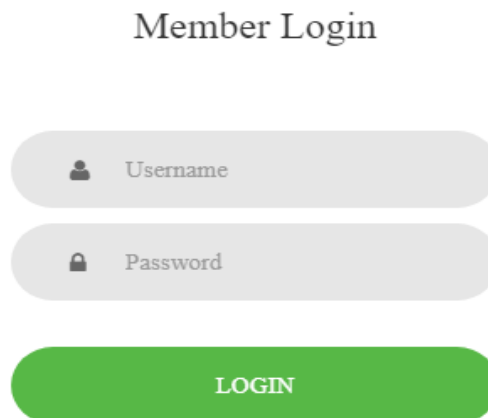


Fig. 2: Login Page Output Design

The activities of the system using flowchart diagram is shown in Figure 3.

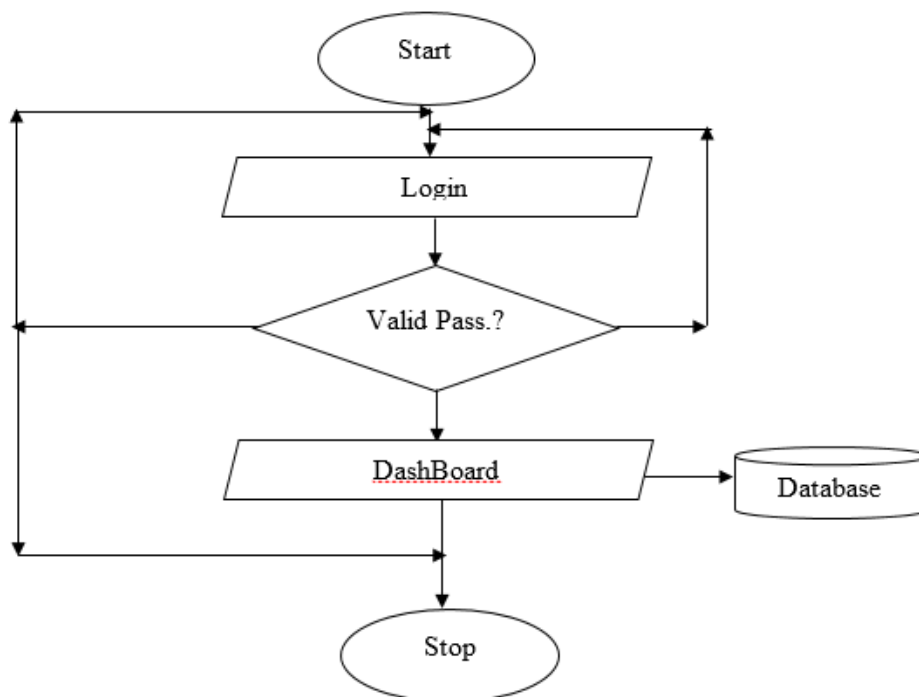


Fig. 3: System Flowchart

4.2 Program Module Specification

The solution is developed using php language, scripts and Sql database. These languages were

chosen because of its object-oriented features and class libraries for developing online applications. The solution contains the system administrator side and the user side. The modules are as follows:

a) The login page:

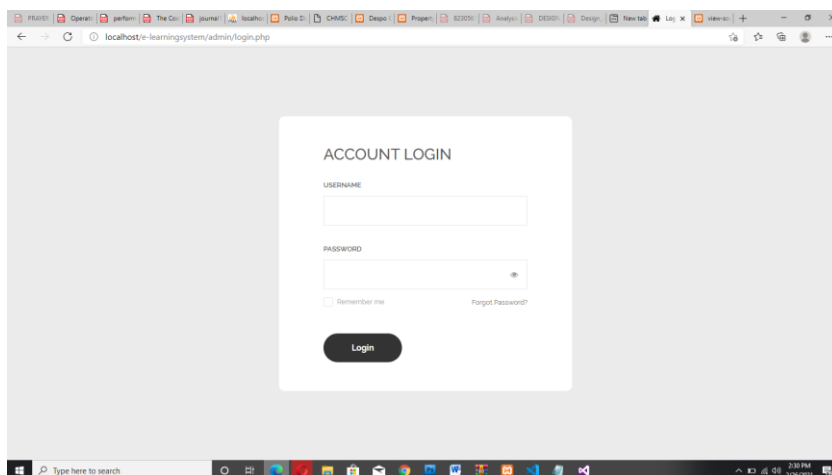


Fig. 5: The Login Page

Here in figure 5 the administrator and the user can login to their own page. The login page is also a way of providing security to the system by preventing unauthorized access to the system. It is an entry page that requires user identification and

authentication, performed by entering a username and password combination. The login provide access to the solution.

b) The registration form:

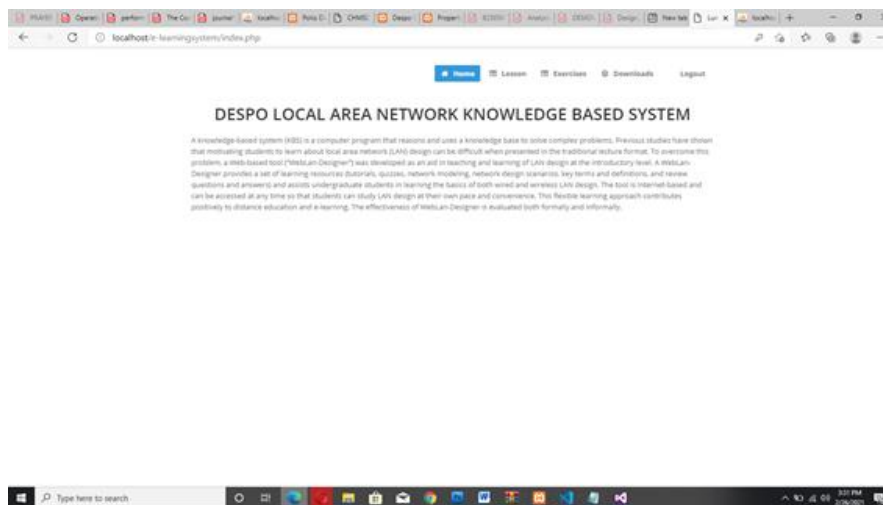


Fig. 6: The Home Page

This is only available for the user as it enables a new user of the system to create account and make use of the system effectively. The registration form is a list of fields that a user will input data into and submit. Once populated and submitted the data is captured into the database.

c) Home:

The figure 6 introduces the home page of the system to new user on how the system works and the basic things to know about the system. It also

helps to navigate from one module to another. The home page is primary web page which a user navigating to other links of the solution.

d) Lesson:

This is where user can take lesson one by one to aid smooth and effective learning through videos and documents in PDF format.

e) Exercises:

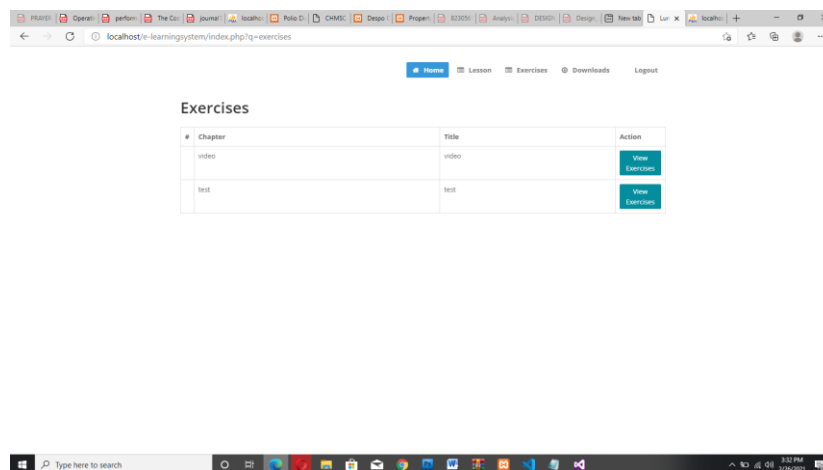


Fig. 7: The Exercises

In figure 7 the user can test his/her skills through self-evaluation quizzes.

f) Download:

The system is online; therefore, this module enables the user to download contents from the website to enable learning online or offline.

5.0 Implementation and Documentation

The platform requirement to run the solution is hardware and software that aid the efficient and effective utilization of the newly designed software. The hardware requirement of intel computer or a smart device with a processor of 2 giga hertz (gh), at least memory capacity of 2 giga byte (gb). The software requirement for this system are: an operating system (os), a virtual server that is Xampp/Wamp server and a browser.

6.0 Conclusion and Recommendation

In this paper the importance of information sharing on a particular subject matter on computer networks through a knowledge-based system was emphasized. Computer networks is an enabler to the dispersion of knowledge. Hence, the paper presented insight to the learning of local area network in practice and theory through the electronic learning process. The study noted that in today's world that most activity is driven by the convergence of information and communication technologies a knowledge-based centric approach to the learning of LAN in a non-conventional method. The significance therefore, is the design of a system that render assistance to computer scientist to know about LAN in an interactive and simplify way to avoid errors during installation and maintenance of computer networks. Furthermore, the scientific clarification in this work is the principle of different types of network configuration are been highlighted. And emphasis is made on the installation and maintenance techniques, the study added the scientific impact to design a system which shall render an assistance to the computer scientist during the installation and maintenance of a computer network. Moreover, proper installation of various component of the networks are achieved and the prevention and corrective maintenance are properly added

We recommend that the knowledge shared here can be adopted by prospective learners and educational institutions in the teaching and learning of the theory and practice of local area networks.

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